Your Car's Air Brakes, An Introduction

By Martin McDonough

This is the first of a two-part series on air brakes. Every private car owner should have some basic knowledge of how air brakes work. It will aid you in better understanding your own car's air brake equipment and broaden your understanding of what the engineer is doing at the head end of your train.

As the train to which your private car is attached moves along the track. it develops kinetic energy, the energy of motion. Getting rid of this energy safely is the problem tackled by the engineer every time the train needs to be slowed down or stopped. This is done through the heat developed in the braking process.

The principal function of a brake is to absorb kinetic energy. This makes your car's air brake system a heat engine in reverse. Instead of converting heat into energy, your car's air brakes convert kinetic energy (the inertia of the train) into heat when slowing down or stopping your train. This heat is transferred from the operating surfaces of the wheels into the brake shoes Just as rapidly as it is produced.

On cars with tread brakes, the car's wheels act as brake drums in absorbing the heat generated by braking. On cars with disc brakes (PRIVATE VARNISH, January/February 1986, pages 18-21), this brake drum function is performed by a disc bolted to the inner hub of the wheel. The brake disc has been precision engineered to perform this heat exchange function most efficiently.

Air to fill your train's brake line comes from the locomotive's air compressor. The compressor takes in air from the outside atmosphere and compresses it almost ten times to a pressure of 140 pounds-per-square-inch. This pressurized air is stored in reservoirs on the locomotive.

Charging and recharging of locomotive air reservoirs is controlled by an air pressure governor. The governor stops the air compressor charging process when reservoir air pressure reaches 140 psi. When the air pressure ,drops to 130 psi, the governor automatically cuts in. restoring locomotive air reservoir pressure to 140 psi thereby assuring a constant supply of air for all locomotive and train braking functions.

All locomotives are equipped with an automatic brake valve When the engineer cuts in this valve by placing the automatic brake valve's brake pipe cut-out cock handle in the horizontal position and places the automatic brake valve handle in the release position, pressurized air flows from the reservoirs aboard the locomotive down the train line brake pipe charging air brake valves and reservoirs on each car. Passenger car air brake systems of all types operate on up to 110 psi for all air braking functions.

When the engineer wants to slow down or stop the train, he makes a brake reduction by reducing and exhausting into the atmosphere some of the air in the train line brake pipe. Passenger car air brake valves on all cars in the train, including your private car, respond to this reduction in brake pipe air pressure by permitting air to flow from each car's reservoirs to the brake cylinders. This air brake cylinder pressure is then converted into a mechanical force which is delivered to the wheel tread or brake disc through the truck's foundation brake rigging and brake shoes. When the exact amount of air in the brake cylinders is equal to the amount of the engineer's brake reduction, your car's valves automatically assume what is known as a lap position, meaning there is no further movement.

When the engineer is ready to release the brakes, the automatic brake valve handle is moved to the release position. Each individual passenger car's air brake valves once again respond to the air pressure differential in the train

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line brake pipe, assume the release position, exhaust brake cylinder air into the outside atmosphere and recharge the car's reservoirs to replace air used in the brake application.

The brain of your car's air brake system is the control valve. When the pressure in the train line brake pipe is charged, air pressure differentials occur in the control valve causing valve components inside the valve to change position. When train line brake pipe pressure increases, the control valve assumes a brake release position. This release may be either partial or full depending on the position of the engineer's automatic brake valve handle.

When train line brake pipe pressure decreases, a brake application occurs. In a brake application, control valve differential causes interior valve components to change position once again and pressurize the brake cylinders. Once applied, the brakes will remain applied at a constant pressure as long as the train line brake pipe air pressure continues to remain reduced at a constant rate.

There are two types of brake applications. The first is a normal service application. In this type of brake application, air pressure in the train line brake pipe is reduced at a controlled rate, set in motion by the engineer through the automatic brake valve in the locomotive.

The second type is an emergency brake application, normally used in an unusual situation. An emergency brake application can be set in motion by the engineer, initiated at the conductor's valve inside your car, when a brake pipe is broken or when air hoses between cars separate. An emergency brake application cannot be stopped or slowed down. Once initiated, this type of application is under the control of each individual car's air brake equipment which instantaneously drains all the air in the car's and train's brake pipe. This feature was designed right from the start to be fail-safe.

Many of today's private cars are equipped with relay valves. These valves work together with the control valve which sends out the signal to apply or release the brakes and the relay valve supplies and maintains air in the brake cylinders at the air pressure level established by the control valve. When the control valve is in the release position, the relay valve relays this signal to the brake cylinders and air pressure in the cylinders is exhausted into the outside atmosphere.

As passenger cars and individual car brake pipe lengths developed toward today's 85-foot lengths, the quick service valve was introduced. When the engineer makes a service brake application in the locomotive, the quick service valve activates, reducing the car's brake pipe air pressure, helping the engineer make a faster air reduction. Incidentally, if you're near one of these valves while a service application is being made, notice the valve appears to breathe since the reduction is intermittent.

Amtrak requires your private car have at least one conductor's valve. Good judgement must be used when activating this valve while your train is in motion. Once the handle on the conductor's valve is pulled, a non-stoppable emergency brake application will result. Several seconds will elapse before the full force of the brake application takes hold allowing for some quick safety actions within your car. If you experience an emergency brake application, check your car's wheels for possible damage as soon as possible thereafter.

Some older cars still have the type of retainer valve that is bolted to a collision post at the vestibule end of the car. If yours has not already been disconnected or removed entirely, make absolutely sure the retainer valve handle is in the vertical position at all times.

We'll talk more about valves, the complete air brake component system and how and why the Federal Government figures in, all coming up in the next issue of PRIVATE VARNISH as we take a close-up look at COT&S procedures.